

The Digital Way to the Heart of the Nucleus : Free Knowledge & Deep Truths

The pursuit of experimental nuclear physics at both the teaching as well as research level is, at times, prohibitively difficult owing to the required resources and allied expenses. In addition to the expenditures, the burden of maintaining the setups through massive and prolonged usage is often a bottleneck in upholding the quality of training that the laboratory course aspires to impart. As of today little can be done to circumvent the requirement to use commercially available radiation detectors, however, it is possible to dispense with, the conventional pulse processing systems, atleast for the basic laboratory level courses, by taking recourse to the contemporary digital signal processing methodology, as would be detailed during the presentation. The methodology utilizes the open source resources for pulse processing as well as the data acquisition. With this approach, the basic representations of nuclear phenomena, such as spectrum of a radioactive source, can be efficiently accomplished for an illustrative training of the students.

The experience in dabbling with the DSP algorithms has paved way for the Nuclear Physics Group at the Kolkata Centre of the Consortium in the developmental endeavours associated with the digital signal processing and data acquisition, in the vibrant domain of in-beam gamma ray spectroscopy, being actively pursued using the Indian National Gamma Array. One of the recent implementations of such a system has been in a campaign of the Indian National Gamma Array (INGA) hosted at the Room Temperature Cyclotron (RTC) of the Variable Energy Cyclotron Centre (VECC), Kolkata. The system befits spectroscopic applications, working under a Compton suppressed detector multiplicity based event trigger as well as under condition effecting to a triggerless mode. These developments intend to befriend the user in his quest to probe the nuclear excitations. The odyssey embarks with the generation of the pulses from the detector, following a detection, and wades through processing of the pulse to extract the knowledge within and come up with a representation that embodies the acquired data in a format which can be flexibly accessed at different stages of the continued pursuit.

The Nuclear Physics Group at the UGC-DAE CSR, associated with the development of the digital daq, has members, Dr. R. Raut, Dr. S.S. Ghugre, Dr. A.K. Sinha, Mr. S. Das, Mr. S. Samanta, Mr. S. Chatterjee and Mr. K. Basu. Dr. H. Tan of XIA LLC (USA) has led the fabrication of the daq system at the manufacturing end. The development of an open source counting system was a collaborative endeavour with Prof Amitava Gupta and Shri A Jana from, the School of Nuclear Studies & Applications, Jadavpur University.

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